SHIP PRODUCTION COMMITTEE
FACILITIES AND ENVIRONMENTAL EFFECTS
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EDUCATION AND TRAINING

June 1976
NSRP 0002

THE NATIONAL SHIPBUILDING RESEARCH PROGRAM

Proceedings of the REAPS Technical Symposium

Paper No. 25: Computer Graphics Hardware and Application in Shipbuilding

U.S. DEPARTMENT OF THE NAVY
CARDEROCK DIVISION,
NAVAL SURFACE WARFARE CENTER

Report Documentation Page

Form Approved
OMB No. 0704-0188

1. REPORT DATE	2. REPORT TYPE	3. DATES COVERED
JUN 1976	**N/A**	**-**

4. TITLE AND SUBTITLE	5a. CONTRACT NUMBER
The National Shipbuilding Research Program: Proceedings of the REAPS Technical Symposium Paper No. 25: Computer Graphics Hardware and Application in Shipbuilding	5b. GRANT NUMBER
	5c. PROGRAM ELEMENT NUMBER
6. AUTHOR(S)	5d. PROJECT NUMBER
	5e. TASK NUMBER
	5f. WORK UNIT NUMBER
7. PERFORMING ORGANIZATION NAME(S) AND ADDRESS(ES) **Naval Surface Warfare Center CD Code 2230 - Design Integration Tools Building 192, Room 128 9500 MacArthur Blvd Bethesda, MD 20817-5700**	8. PERFORMING ORGANIZATION REPORT NUMBER
9. SPONSORING/MONITORING AGENCY NAME(S) AND ADDRESS(ES)	10. SPONSOR/MONITOR'S ACRONYM(S)
	11. SPONSOR/MONITOR'S REPORT NUMBER(S)

12. DISTRIBUTION/AVAILABILITY STATEMENT
Approved for public release, distribution unlimited

13. SUPPLEMENTARY NOTES

14. ABSTRACT

15. SUBJECT TERMS

16. SECURITY CLASSIFICATION OF:			17. LIMITATION OF ABSTRACT	18. NUMBER OF PAGES	19a. NAME OF RESPONSIBLE PERSON
a. REPORT	b. ABSTRACT	c. THIS PAGE			
unclassified	**unclassified**	**unclassified**	**SAR**	**16**	

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Proceedings of the REAPS Technical Symposium June 15-16, 1976 Atlanta, Georgia

Research and
Engineering for
Automation and
Productivity in
Shipbuilding

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COMPUTER GRAPHICS HARDWARE AND APPLICATION IN SHIPBUILDING

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The general economical situation in shipbuilding and the cancelation of a number of big tankers has affected many yards in many *ways.* The development and application of computer technology has also been influenced. When it comes to giving priority to development projects on computer applications, the following two criteria are very important:

1. The tools should be able to handle prototype products.
2. Faster return on investment in computer technology.

As to the first point, we do believe that the system we already have is a good starting point. By adding more editing and output functions, we believe that our system will be better suited to handle

.

As to the second p0int,we think it is right to use the same economical criteria for investments in computer technology as we use when investing in any production equipment or technology.

Even if life should be easier for the shipbuilding industry, it is not likely that investments in computer technology will be handled in the same way as 10 - 15 years ago. Most yards will not be allowed to invest in more than they can utilize and make prcfit from within z short period of time.

Those of us who are used to the “good old days” will probabQ react with certain views on how the development of computer assisted systems will progress under such conditions. What about the realization cf all the good ldeas we hzv~e? If we do not get the setup of com–puter hardware and software we had in mind, we do not see how our philosophy can be implemented. This is of course a problem, but there is a solution t. it. Think the situation over once more, but now within the technical and economical framework of today. There is usually another approach, and maybe even a better one.

In cooperation with CIIR, the Akergroup and SRS has worked on these problems for about one and a half years. The aim of the effort. is partly to develop operational application programs, but also to establish a knowjledge about the possibilities of using low cost graphical terminals in our applications. The most significant results from this project are listed below.

An operational interactive parts nesting program.
Subroutine packages for handling of input commands, database administration, error messages, connnunicati.on with graphic displays etc.
A concept and systems design for future develop~ent of such systems.
A specification of a general tocl for editing and presentation, Of drawings fr~.n datbbases containing geomentry elements.
know-how about the computer grayphics technology and available hardware and software.

The last point is of particular interest when it comes to investments and economical aspects. Computer graphics techniques are traditionally based on special and rather expensive equipment. However, when investigating the problem a “bit closer and in the light of the needs the shipbuilding industry has, we have found that a yard may have access to this new technology for a reasonable amount of money.

Computer graphics is very important, but not always central.

Graphical functions are natural ‘parts of systems like Autokon and Autofit. We often think of computer graphics as output functions like scaling, making projections, hidden line rexnoval etc. However, a graphics system has also several input functions which in certain applications may be very useful (digitizing, additional graphical info.via menue printing via display screen etc.).

The “graphical” function in relation to Autokon and Autofit may be split in two categories (see fig. 1):

1. Direct output in connection with the execution of the application programs.

2. Editing and presentation of final drawings (documents).

The type 1 output is typical for the Autokon programs we know today. The output is initiated by some application function and the purpose of the output, is to serve as documentation of the information that resides in the ,database after the execution of the program. An example of such output is the part drawings from ALKON. Other output, like the bodyplan drawing from FAIR and the LANSK1 drawing~ acts both as ~.~ ...n of the database and a base for a physical drawing. The third type pf ou~put is represented by the drawings from SHELL and NEST’, .wllich primarily are a control of the contents of the cutting tapes, but serve also as a base for the production drawings prepared for the operator of the cutting machine. In general, this output is rather rigid as to content and layout. The necessary additions and modifications for getting a final drawing will have to be done by traditional manual means.

The type 2 output is what we will be able to produce when the GDT (General Drafting Tool) is operational. As shown in fig. 1, this drafting function will be implemented as a freestanding system. Scme characteristic data is giveri in fig. 2. The idea behind the system is to give the designer/drz-%sr.an the possibility of making the drawings completely finished by means of a computer graphics system. In adtilticn he will have the drawings and the information on them organized in a database , which we mmay call a “camputer assisted library of drawings”.

The GI)T will serve as & general tool for all applications that require editing of predefined information to produce final drawings. Such a function is very general, because the systen does not have to have any “knowledge” of What the graphics, symbols and text represent

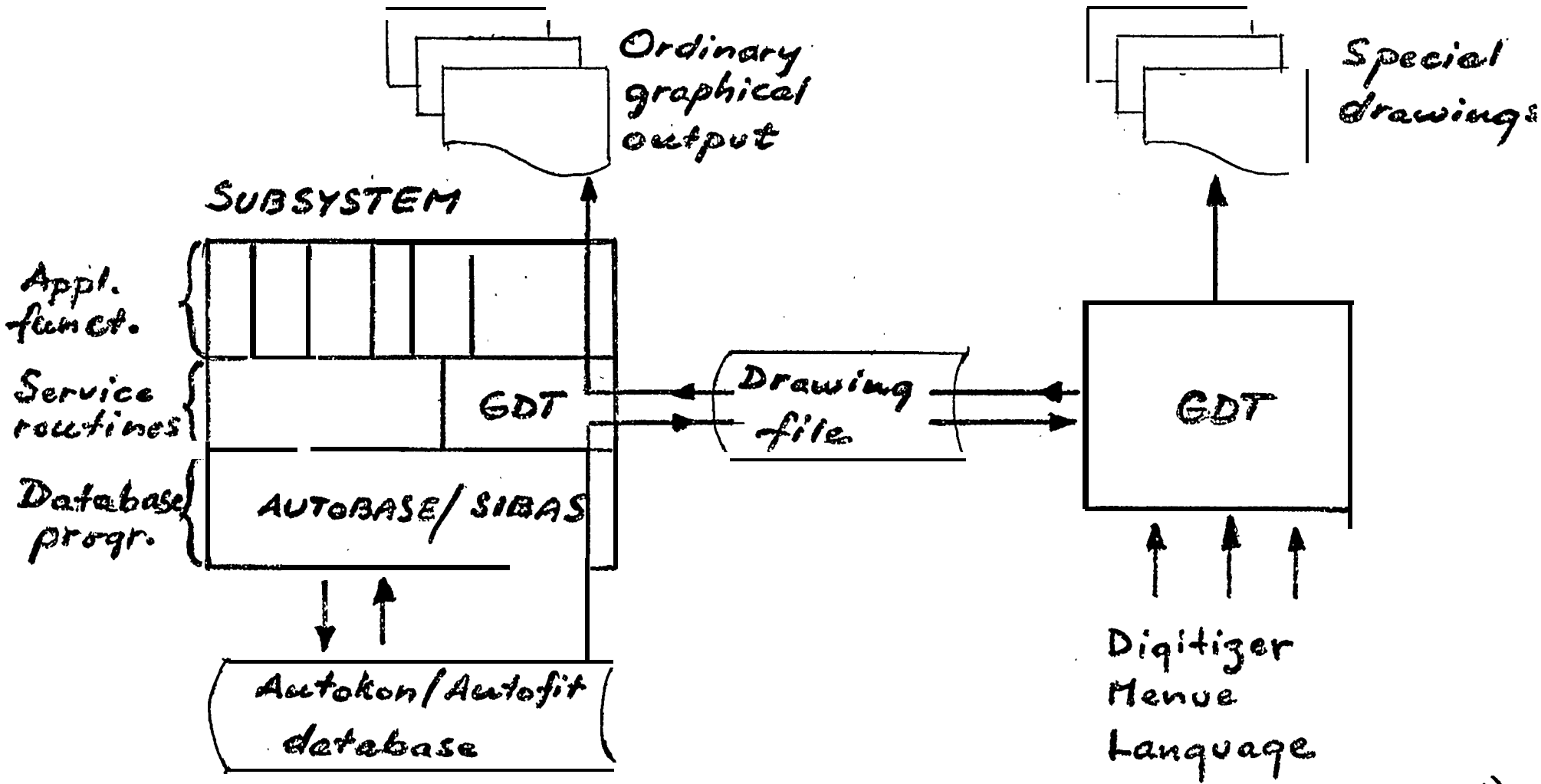


Fig 1

Implicit and explicit implementation of GDT (General Drafting Tool)

PREPARATION OF OUTPUT

START, RESTART, END
INCLUDE, EXCLUDE
TEXT
KILL
POS, ROT, MIRR
SCALE
FORMAT
⋮
etc.

FIG 2

PRESENTATION OF OUTPUT

PRESENT
SHOW
FETCH
DELETE
SPLIT
SELECT
CHARDIM
⋮
etc.

GDT - Examples of functions

Such knowledge i-s supposed to be found partly in the application database, but also in the brain of the designer/draftsmaIi. The idea is, therefore, thaat GDT shall be used with Autokon and Autofit, both as a freestandiig system and in connection with direct output from application programs.

Computer graphics as "turnkey systenm" or "do it yourself kit"?

In our investigation a number of alternatives were listed and removcd from the list again, because they were too expensive or they were not supported in Norway.

In the last phase of The investigation, we had two principal alternatives left:

1. Turnkey system

2. Build our own system from standard components.

The final conclusion was to go for alternative 2 as the main rule, but to buy turnkey systems when that would be the most economical solution to a special graphics problem.

The general characteristics of such a turnkey system are given below. See also general hardware setup in fig. 3.

- Price ranges from $200.000 to $300.000, dependant on the number of work stations and make.

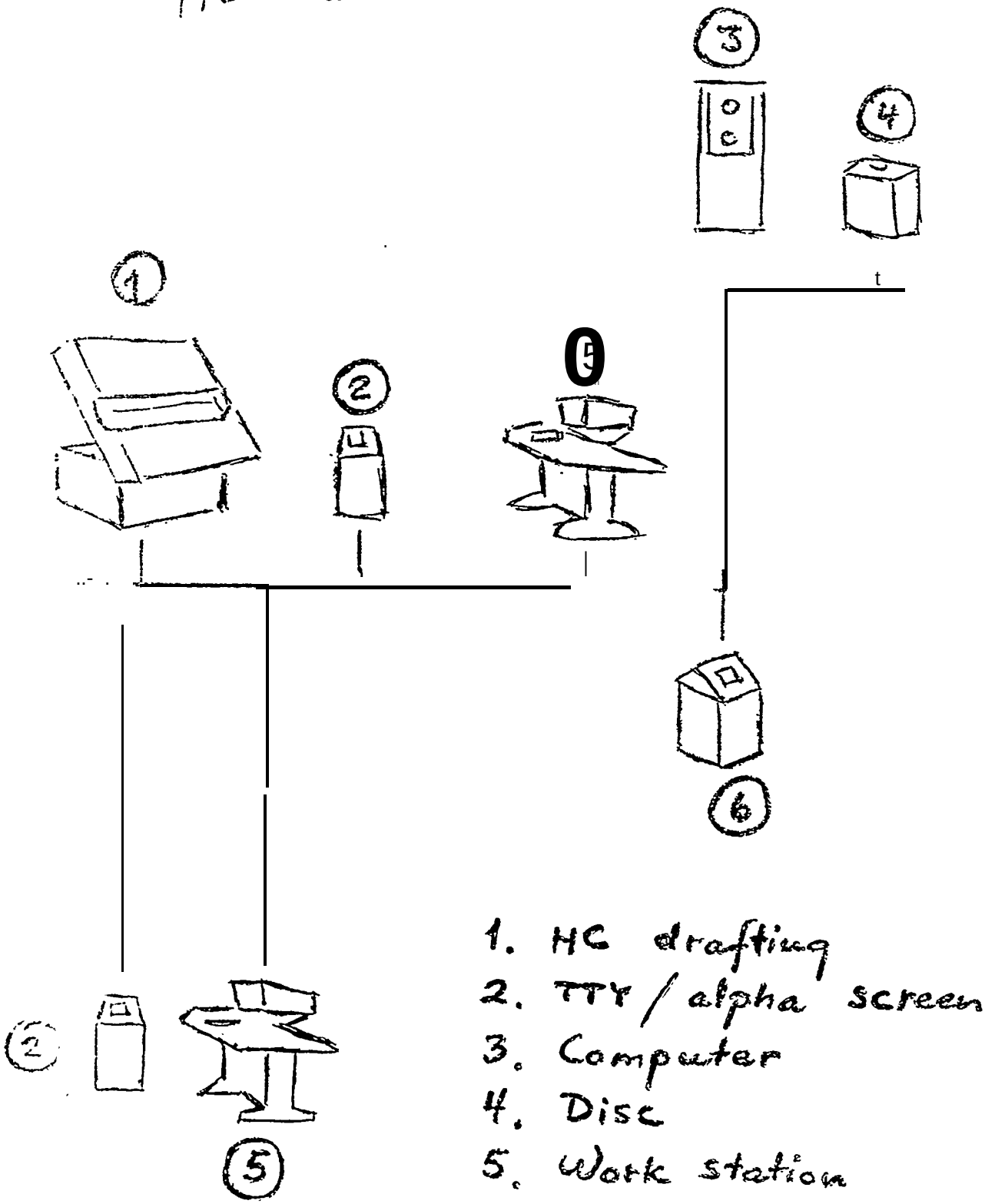
- Typical functions are:

  - 3D geometry input from language, menue and coordinate readout device.

  - Possible to define standard symbols for more effective preparation of drawings.

  - A database for administration of the "drawing file".

FIG 3



1. HC drafting
2. TTY / alpha screen
3. Computer
4. Disc
5. Work station
6. Hardcopy unit.

TYPICAL TURNKEY SYSTEM

possible to get new projections on the basis of the drawings in tune databese.

- Hardware components

  - A number of work stations comprising a graphical screen (storage), keyboard and a :nenue facility.

  - Drafting table

  - Digitizer

  - Computer

  - Disc staticn.

The general -impression is that these systems are powerful and advanced drafting tools. There is a Good integration between the" miscellaneous hardware and software components. This makes a good system for ger.eral drafting, but makes it less suited for integration with other applications. The system is very general, rind quite" a bit of effort will have to be put into it before you have an efficient application tool.

As you will see from the point above, a turnkey system is an interesting drafting tool. How interesting is, however,very dependant on theyard'.s specific needs, its present tools or methods, its philosophy for further development and the economical situation.

After serious considerations, the Aker Group decided not to go for a turnkey solution. Hcwever, computer graphics techniques and equipment for development and use of applications based on this techlnology has a high priority. The development. philosophy will be to buiid up the hard-ware configuration of relativeljj standard ccmponent.s. The system design and the software components will be made fairly general, so that changes in the hardware setup may be easily carried out.

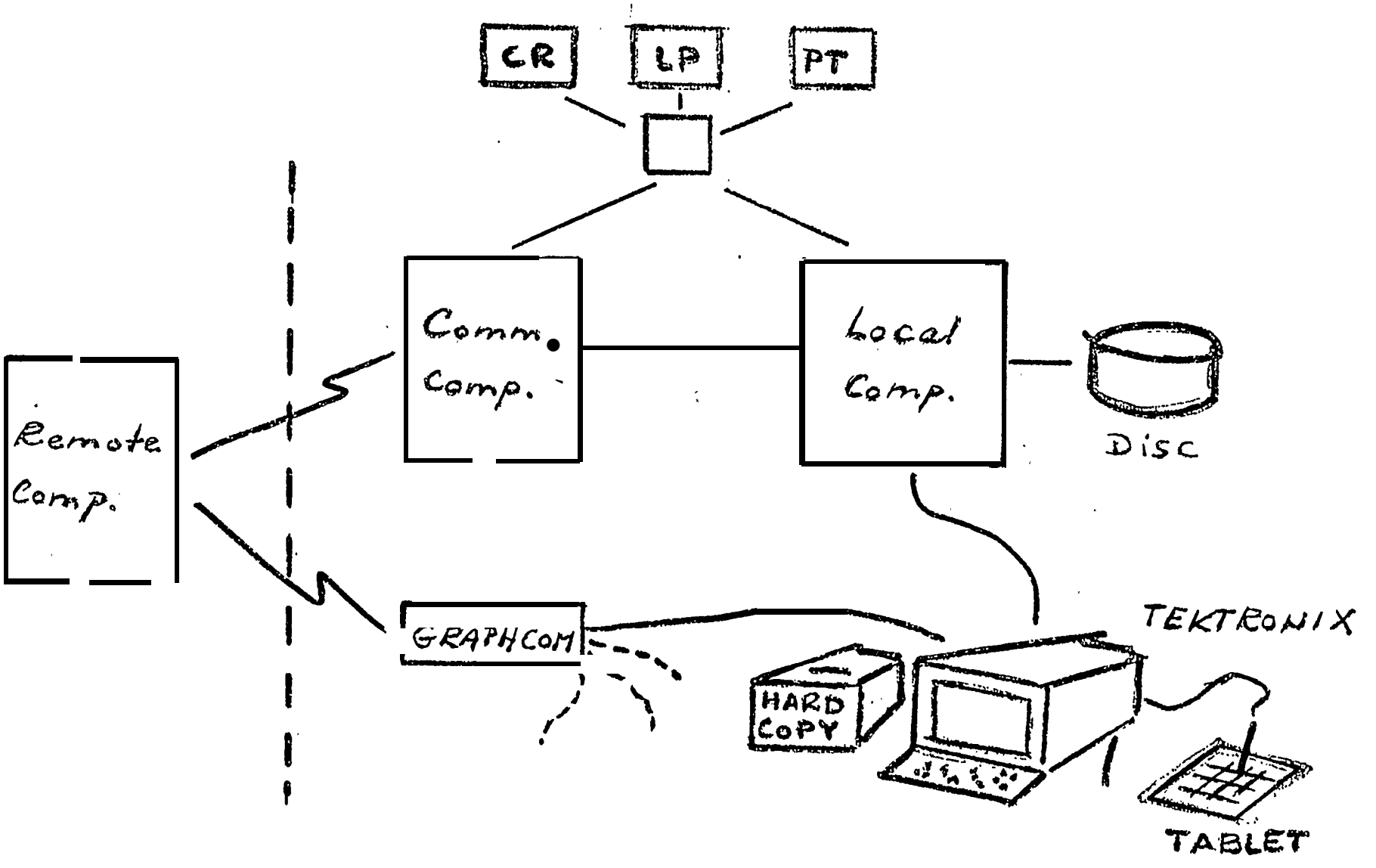
The general setup of hardware is shown in fig. 4. The systems we develop will in most csses be made available both on the central computer and locally. The hardware situation will be different from one yard to another, and the volume of the application will vary quite a bit.

When there is a need for a big computer to solve the application problem or when the application volume is fairly low, the alternative with direct access to a central computer is very interesting. If the volume is very low, an ordinary 300 - 600 baud connection will be sufficient. However, most applications will benefit frcm a higher transmission speed. If a GRAPHCOf.1 adapter is inserted on the line, the speed may be increased to 9600 baud. The same adapter may be used as a line concentrator for up to 4 terminals simultaneously. In addition, .'.r EC?"C hardcopy units may be added. Normally one unit may be shared between a number of terminals (maximum 1). If then the terminals are equipped with a 'tablet , input may be given via menues, and the resulting setup will be a rather efficient tool. The price for this will depend on which level is chosen. Approximate component prices are (in Norway):

TEKTRONIX 4014 display	$13.000
TEKTROHIX hardcopy unit	$6.000
GRAPHCOM adapter	$9.000
TEKTRONIX tablet	$6.000

From a user's point of view, the alternative with a local computer is very similar to the remote computer alternative. What differences he will see will prcbably vary with the type of computer and the application.

The implementation of such a system will be rather different from one yard to another. The implementation sequence and the dimensioning of the equipment (number of terminials, disc # capacity etc) will depend on what equipment the yard has available> the application to be supported, the volwne of the appication.



HARDWARE SETUP

FIG 4

Drvelcn.xnent plans

So far, two systems are operational:

1. Interactive parts nesting program, which is implemented on a local computer. Its input is based on part descriptions made by ALKON, and stored in a Autokon database. The parts are produced on the remote computer and transferred to the local. computer via telephone line and a communication computer.

2. On–1ine preparation of isometric pipe drawings. This system is implem.entcd on a remote computer, and is operated from a TEKTRONIX 4014 display via a telephone line. We do not have ‘ a GRAPHCON adapter yet, snd the transmission speed is 300 baud.

These two developments are right now in a final testing stage in the design offices, and will be in full operation within this year.

The next development will continue on the line we have started. Within this year three projects will be started:

1. On-1ine parts coding and editing. This will be a set of coding and editing commands to support the parts nesting function we already have. The idea is to do the main bulk of the parts generation by means of ALKON on. the big computer and transfer these to the local cor.puter for modification, if needed, and finally nesting.

2. The General Drafting Tool (GDT) will be implemented as a free-standing system with necessary functions for editing and presentation of drawings. It will be based on predefinecl geometry from one Autokon database. In this version of the system, only 212 functions will be implemented.

3. The third project with a graphics approach, will be the Autofit subsystem fcr preparation of functional models and diagrams for piping systems (P&I diagrams). This is an

example of an application where the graphics part of the system will be rather peripheral to the application, but anyway important as a bridge between the application database and the user.

In addition we will conticue our work 'with simple utilizati~n of the display terminal as fast "drafting machine" for output from our present programs.

Conclusions

Today's technology will help the shipbuilder in adding a new dimension to the present CAD systems. Conputer graphics implies on-line access to the computer system, and.will give the users a more direct contact with the computer assisted design process. Fest information retrieval and graphical presentation:: of the contents of the database will make the database-more user oriented than today.

The computer graphics technology is now developed far enough to be applicable in CAD systems for use in the shipbuiling industry. It is however a long way before wc see the end of this development, and our present systems should be made flexible enough to be able.to absorb elements from the further development.